

LETTERS TO THE EDITOR.

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Prof. Boltzmann and the Kinetic Theory of Gases.

IN the discussion which followed the communication of my Report on Thermodynamics to the British Association at Oxford this year, Prof. Boltzmann made some remarks which appear to have been interpreted in a different light to what he doubtless intended. In the absence of any shorthand writer's verbatim report of the discussion, it is of course impossible to recall his exact words, but I feel sure that Prof. Boltzmann will be much astonished to learn that his statements are now widely circulated and quoted as being an authoritative admission that the Kinetic Theory of Gases is nothing more than a purely mathematical investigation, the results of which are not in accord with physical phenomena; in short, a mere useless mathematical plaything.

Is it likely that such an able physicist would have devoted so many years to the development of the theory, and would continue to work at it now if he regarded it in that light? Having had several conversations with him, both during and after the British Association meeting, I gather that his views are not nearly so pessimistic as the opponents of the kinetic theory would wish to maintain.

The statements were made in reply to a question as to how far the ratios of the specific heats of gases as given by theory accorded with the results of experiment. What I understood Prof. Boltzmann to imply was that his investigations treated the matter purely from a mathematical standpoint, but that the values he obtained by regarding the molecules of a gas as rigid bodies, viz. 1.6 for smooth spheres, 1.4 for smooth solids of revolution, and 1.3 for solids of any other form, accorded on the whole *very fairly* with the results of experiment. In that respect the kinetic theory stands on exactly the same footing as any other theory of mathematical physics. The evidence in favour of the fundamental assumptions of any theory necessarily rests on the agreement or want of agreement of the deductions with experience after due allowance is made for the fact that the conditions imposed by the mathematical difficulties of the investigation necessarily differ from those occurring in nature. I need only refer to Prof. Boltzmann's paper, "Ueber die Natur der Gasmoleküle" (*Sitzungsberichte der Wiener Akademie*, lxxiv. ii. 1876), for a more detailed account of his views on the question of the specific heats.

The objection which has been regarded by some as most antagonistic to the kinetic theory is that it does not afford an explanation of the spectra of gases. But is this duty required of it? If the luminosity of gases were due to vibrations of the atoms in the molecules, certainly there *would* be a difficulty about regarding the molecules as rigid bodies; but then such a hypothesis would preclude a gas whose molecules were monatomic from having any optical properties whatever. To my mind, the electromagnetic theory of light entirely relieves the kinetic theory from the burden which has been imposed on it by its opponents, since if (for example) we regard the molecules of a gas as perfectly conducting hard spheres, spheroids, or other bodies moving about in a dielectric "vacuum" (*i.e.* space devoid of ordinary matter), we shall be able to account for the spectra by means of electromagnetic oscillations determined by surface harmonics of different orders without interfering with the assumptions required for explaining the specific heats of gases. There are, however, other questions on which I should be glad to see a continuation of the brilliant discussion which had to be curtailed from want of time at Oxford. G. H. BRYAN.

Peterhouse, Cambridge, October 23,

Instinctive Attitudes.

MY attention has been called to Mr. H. M. Stanley's remarks on instinctive attitudes in NATURE of Oct. 18. I have been for some years studying children's attitudes and expressions from the evolution point of view; and have from time to time taken photographs as opportunity presented itself. I have now a considerable number which I hope to publish in that connection.

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One of the series accompanies this, and bears on Mr. Stanley's remarks. It was taken in May last, representing my youngest child, then ten months old. She never crawled, but always progressed on all-fours; and this photograph, taken instantaneously, shows her mode of travel to and fro on the garden path. The interesting thing about it is this: that the gait is front and back legs on opposite sides, like a dog or a cat, not on the same side, like a camel—a result which the evolutionist would have predicted; though of course we show a relic of the same habit in walking, by swinging the arm on the opposite, and not on the same, side as the leg. In this photograph, too, the heel and toe action of the hind limbs is instructive.

One of my children, in addition to the ordinary crawl, used to progress in a sort of three-legged fashion—it used the left hand



and the right foot for the forward step, rested itself on the shank of the left leg tucked under its body, and this it used as a foot to bring forward its body for the next step. Sometimes this developed into a three step mode of progression.

The bandaging, swaddling, carrying and wheeling about, which the civilised infant has suffered for many generations, no doubt partly accounts for the rarity of the quadrupedal mode of progression, by having hindered development of muscularity. The quadrupedal mode of progression indicates greater strength than the ordinary knee-crawl. S. S. BUCKMAN.

Cheltenham, October 24.

James Parkinson, the Author of "Organic Remains of a Former World."

IN a paper on the subject of museums, which was read in 1891 before the meeting of an association, James Parkinson is thus spoken of without any subsequent qualification of the statement made:—

"Finally, a private lottery was arranged for its disposal (the Leverian Museum), and in 1785 the prize was drawn by James Parkinson, a dentist, who took not the least interest in natural history or in museums."

As the scientific world seems profoundly ignorant as to what were the scientific qualifications and professional position of James Parkinson, the following facts may be worth publishing in NATURE:—

James Parkinson, who resided at No. 1 Hoxton Square, was not a dentist, but a surgeon. In Johnston's Directory for 1817 his address is thus given: "Parkinson and Son, Surgeons, No. 1 Hoxton Square." He had also an address in the Kingsland Road. His death is thus recorded in the *Gentleman's Magazine* of December 1824: "December 21st, in Kingsland Road, James Parkinson, surgeon, late of Hoxton Square." There was a firm of dentists in London, whose address in Johnston's Directory was as follows:—"Parkinson and Kidman, surgeon-dentists, 1 Racquet Court, Fleet Street"; but they had evidently no professional connection with James Parkinson.

The following list of works, &c., by James Parkinson, published by H. D. Symonds, Paternoster Row, is given at the end of a little book by him, of which the title is "Dangerous Sports; a Tale addressed to Children," printed for H. D.

Symonds, Paternoster Row, 1808. Their titles, which I briefly give, will amply prove his professional position:—

- (1) "Medical Admonitions to Families." 5th edition.
- (2) "Observations on the Excessive Indulgence of Children."
- (3) "The Village Friend and Physician." 2nd edition.
- (4) "The Way to Health."
- (5) "The Chemical Pocket-Book."
- (6) "Hints for the Improvement of Trusses."
- (7) "The Hospital Pupil."
- (8) "Observations on the Nature and Cure of Gout."
- (9) "Remarks on Mr. Whitbread's Plan for the Education of the Poor."
- (10) "Organic Remains of a Former World." Volume the First.

In addition to his "Organic Remains," Parkinson produced "Elements of Oryctology, an Introduction to the Study of Fossil Organic Remains," which appeared in 1822. A third edition was published in 1840.

Whatever may have been Parkinson's lack of interest in natural history when he acquired the museum, he certainly showed no deficiency in that respect when he produced his "Organic Remains of a Former World," one of the most valuable and interesting works of the kind that I know. For further information with regard to Parkinson, see the Introduction to Mantell's "Atlas of Fossil Remains," published by H. G. Bohn in 1850, in which Parkinson's splendid plates are reproduced. See also Allibone's "Dictionary of British and American Authors"; London, 1870.

SPENCER GEORGE PERCEVAL.

Henbury, Bristol, October 29.

On Chinese Beliefs about the North.

FROM a review in NATURE for the 27th ult. (p. 522) I have been led to conclude that the "Theory of the Northern Origin of the Chinese" enjoys the confidence of scientific men. Should this conclusion really be correct, the theory will give strong support to the view which occurred to me while reading the review.

By Sze-má Kwáng, a Chinese Prime Minister of great classic knowledge (died 1086), the Rite of "Fuh" (*i.e.* bringing back), anciently observed before changing the clothes of deceased parents, is detailed as follows:—"Take a clean suit of clothes prepared for the corpse up to the ridge of the roof; then towards the north call three times 'Pray, return'; then fold up and bring down the suit to clothe the corpse; to detain the soul thus brought back, fasten the suit with silk (silken band); before the burial offer to it viands and utensils with as much reverence as is due to the parents alive" (1). In this ritual I notice three primitive beliefs unitedly preserved: firstly, that the soul of the deceased could return if called, the belief current among the Hos, the Bank's Islanders, and the Fijians of modern times (2); secondly, that one could detain the soul from departing by fastening a garment while addressing to the deceased, as is meant by an old Japanese usage on occasion of meeting the *passing soul*, *i.e.*, *ignis fatuus* (3). In the third place, as is the case with the Kookies (4), this ritual indicates the primitive Chinese belief in the *existence of their other world in the north*.

The Early Chinese system of cosmogony, which is now fragmentally but uniformly preserved in the books of two antagonistic religions, viz. Confucianism and Taoism, has its God of the North named "Hüen-Ming," *i.e.* "Entering Other World" (5).

Cháng Hwá, a Prime Minister of encyclopædic erudition (killed 300 A.D.), mentions in his work a Taoist belief in the other world as extensive as 200,000 *lis* square, situated underground in the north (6). Another Taoist Eschatology, written in the 9th century A.D., relates that "the Emperor Yen-teh, who was created the 'Grand Imperial Master of the North,' governs all spiritual beings" (7). Most probably connected with these beliefs is a folk-tale of the "South Dipper," the life-registrar, and the "North Dipper," the death-registrar" (8), from which is derived a popular romance of Chau Yen's bribery to the latter star-god in order to have his destined longevity increased from nineteen years to ninety-nine (9).

The Yoghacharya mystics of China define the north as "the point whereat all the works are doomed to finish," and hence "the point of entering Nirvāna" (10). A dispute about whether Chinese Buddhism in this case is entirely free from the taint of Celestial gloss, I am not qualified to decide.

Now let us return to Confucian literature. Confucius's own opinion regarding the other world appears of quite agnostic character, as is implied in his answer to Tze-lu (who inquired about the state of death)—"While you do not know life, what can you know about death?" (11); as well as in his answer to Tze-kung (whose question was about whether the deceased had consciousness)—"If you die, you will know; even then it will not be too late to know" (12). But it is in those ancient sages' tenets, which the great master preserved in his doctrine, that the early Chinese belief in the northern spirit-land had been so predominant, though tacitly implied, as to have caused an all-reaching association of the North with everything related to Death. So, early they styled the rooms containing ancestral tablets the "North Temples" (13), and by the name "North Hill" the graveyard has always been understood.

According to the "Tang-kung" (a portion of the *Book of Rites*), Confucius was buried in the northern part of the capital of Lu, and "the burial in the northern sides of towns was the persistent custom of the three 'classic dynasties,' *i.e.* Hia, Ying, and Chau" (14). Forcibly this statement reminds us of the Damaras, who place the corpse with the face towards the north, to remind them whence they originally came; and also of the Yncas, who, expecting to go to the east whence they came, turned the face of the corpse to the east; while the aboriginal Peruvians did not follow the same usage (15). In fact, we find in Chinese records certain abnormal examples, which indicate the stocks distinct from original Chinese; thus, two corpses of different sexes discovered from the mound of Prince Tsükü, a Hiung-nü by descent, are said to have had their heads turned eastwards (16).

Mr. Herbert Spencer, after reasoning from materials extensively collected, remarks: "Immigrant races have for their other-worlds the abodes of their fathers, to which they journey after death" (17); and unless they are an exception to this general rule, the Chinese, whose old customs and traditions have been shown to tend so much towards evincing their early belief in the northern spirit-land, must have originally entered their present domain from the North.

Also, in early Chinese speculations the north had been fixed on as the store and source of the originating principle "Yin" (or *Negativity*), and it has ever since been associated with everything of "negative" characters—*e.g.* reposing, obscuring, destroying, &c. Thus, in the symbolism of "Wu-háng" (the *Five Elements*), water and winter are posted at the north (18); of the nine divisions of the heavens the northern and the north-western are named respectively "Dark Heaven" and "Dusky Heaven" (19); of the five mountains worshiped by emperors the northernmost one is called "Eternal Mountain" (*Han Shan*), because all beings are doomed to eternal repose in the north (20); and referring to the then admitted axiom—"the north is the realm of slaughters and assaults"—Confucius once reproved Tze-lu for playing on a stringed instrument in the "northern tones" (21).

As there should be nothing other than Death that might combine in itself all conceivable characters of Negativity, it would seem quite reasonable to trace the origin of these associations of North and Negativity of Chinese speculations into the old custom of burying in grounds lying towards the north, which custom in its turn is easily traced to the early Chinese entrance from the north.

Bibliography.—(1) Kumazawa, "Sōsai Benron," Tokio, 1890, p. 4. (2) Spencer, "Principles of Sociology," 3rd edition, vol. i. § 83. (3) Terashima, "Wakan Sansai-zue," 1713, tom. lviii. sub. "Hitotama." (4) Spencer, § 112. (5) Pan Kū, Peh-hū-tung, 79 A.D. tom. ii. chap. i. (6) Pōh-wuh-chi, tom. i. chap. ii. (7) Twan Chiag-shih, "Yü-yáng Tsáh-tsü," tom. ii. (8) Sie Tsái-kang, "Wu-tsáh-tsü," circa 1610, tom. i. (9) "Yen-i-Sán-kwóh-chi," Kin's edition 1644, tom. xxxv. pp. 4-5. (10) In-yü, "Mandara Shishō," 1491, tom. i. (11) "Confucian Analects," chap. xi. (12) "Encyclopædia Britannica," 9th edition, vol. vi. p. 265. (13) Ying Chau, "Fung-siuh-tung," 2nd cent. A.D. tom. ix. chap. ix. (14) "Siun-tze," circa 255 B.C. xxviii. (15) "Peh-hū-tung," tom. iv. chap. x. (16) Spencer, § 112. (17) Li Shih, "Süih Pōh-wuh-chi," 13th cent. A.D. tom. viii. (18) Spencer, § 115. (19) "Peh-hū-tung," tom. ii. chap. i. (20) "Lü-shi Chün-tsiu," circa 239 B.C. tom. xiii. chap. i. (21) "Shwōh-yuen," 1st cent. B.C. tom. xix.

KUMAGUSU MINAKATA.

15 Blithfield Street, Kensington, W., October 16.